

# PostScript

## LETTERS

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## Siberian live birth sex ratios and the SPROO hypothesis

Melnikov and Grech found a highly significant seasonal pattern of the sex ratio (SR) at birth in western Siberia, namely, a peak in the second and a trough in the fourth quarter of the year.<sup>1</sup> This peak and trough are in line with the seasonal preovulatory overripeness ovopathy (SPROO) hypothesis, which states (1) an approach to gender equity at the peak of the "ovulatory" seasons, (2) preferential fertilisation of non-optimally matured oocytes by Y-bearing sperm during the transitional stages between them, and (3) SR reversal because of excess of male biased fetal loss during the "anovulatory" seasons.<sup>2</sup> The mentioned peak would correspond, just like in non-human mammals with the breakdown of the "ovulatory" season in spring; the trough with SR reversal during the "anovulatory" season in winter.

The authors wonder about the annual secular trend in a fall and then rise of the SR with the turning point in early 1980s, being different from the continuous decline in industrial countries over the past half century. We have argued that the rise in SRs before the first world war in Finland<sup>3</sup> and in many other countries concurred with continuous improvement in living conditions, education, and reproductive hygiene, and, thus, a decrease of conceptopathology rate, and in turn, increase of male surviving fetuses.<sup>4</sup> The fall of the SRs after the turning point around the second world war was interpreted as consequence of further amelioration of the ovulatory and conception pattern, reflected by the concurrent decrease in pregnancy wastage. The same reasoning accounts for the initial very low and then increasing and again decreasing SRs in developmental countries that are in demographic transition going hand in hand with amelioration of socioeconomic conditions. This may be compared with the rise and fall in socially upward family conditions.<sup>5</sup> The odds for delivering a male child increases (while pregnancy loss diminishes) when the socioeconomic level increases from low to moderate up to a plateau and then decreases (despite continuation of

decreasing pregnancy wastage) when this level increases further from moderate to higher.

The relatively low SRs in western Siberia, when compared with other countries in west Europe, may also be related to higher rates of conceptopathology because of the extreme climatic variations and inherent stronger seasonal variation in reproduction further away from the equator. This suggests higher rates of male biased pregnancy loss as the underlying mechanism. The SR increase in the early 1980s would mean that this rate is diminishing and that further progress in socioeconomic conditions will result in still higher SRs and ultimately in a decrease, in analogy with those in west European countries.

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- 4 Jongbloet PH, Zielhuis GA, Groenewoud HMM, et al. The secular trends in male:female ratio at birth in postwar industrialized countries. *Environ Health Perspect* 2001;109:749-52.
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## Siberian pros and cons of the SPROO hypothesis

I thank Dr Jongbloet for thoughtful response to our article. According to the SPROO hypothesis, human females have a fundamental seasonal variation in ovulatory pattern, one of several factors explaining differences in sex ratio (SR). The hypothesis presumes inherent ovulatory and anovulatory seasons and suggests that secondary SR varies over the year from the femininity, or an approach to gender equality, coinciding with the zenith of birth frequency, to the excess of male births concentrating at the beginning and the end of this optimum. The question is what are these seasons in Siberia?

An analysis of our data by month yielded the seasonal pattern for SR variation ( $p < 0.1$ , Edwards' test). According to the hypothesis, the birth optimum should occur in February-March when the small trough in SR is observed. This period of gender equality corresponds to the "ovulatory" season in May-June. This trough in turn was preceded by a sharp peak in SR occurring in January and followed by the major peak in April-June.

These two peaks might seem to reflect "transitional stages".

What are the arguments against the hypothesis?

Huntington's 1938 report of the seasonal variation in both the SR and the total number of births in seven countries, based on analysis of about  $52 \times 10^6$  births, showed an inverse relation between the SR and the number of births.<sup>1</sup> Just the contrary is apparent in Siberia. These two curves agree closely at least during the first half of the year. In other words, the total number of births and the number of male births vary correspondingly. This direct relation between SR and birth number seems to be a characteristic feature of the Siberian population.

An analysis of 1989 Novosibirsk census data shows that January born males and females comprise 20.8% and 24.2%, respectively, of men and women aged more than 80 years, whereas the expected proportions according to the uniform distribution would be  $100/12 = 8.3\%$ . This means that January as a month of birth and April as a month of conception are strong predictors of longevity in Siberia. However, in accordance with the hypothesis, April ought to be a month of conceptopathology, associated with "preferential fertilisation of non-optimally matured oocytes by Y-bearing sperm" and would consequently not seem to be associated with the surprisingly long span of life seen in this cohort.

In summary, while I agree that some aspects of the Siberian data are "in line with" the SPROO hypothesis, I do not find this concept to be the most satisfying explanation of our findings. While the hypothesis has been supported by animal studies, its reliance on mechanisms such as ovopathy and differential pregnancy loss makes it difficult to establish (or refute) on the basis of studies such as our own. We remain persuaded that A Lerchl's hypothesis of the temperature dependence of SR better explains our peak of total and male births in January.<sup>2</sup>

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## Ethnicity and epidemiological research: not so black and white

The analysis by Ahern *et al* of risk factors for preterm birth among African American and white women in San Francisco<sup>1</sup> concluded that pregnant African American smokers are more prone to preterm delivery than white pregnant smokers. This conclusion is misleading. Firstly, the evidence of interaction between smoking and ethnicity was unconvincing—the difference in the odds ratios